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ACTIVITIES OF THE CO-ORDINATING COMMITTEE ON GREAT LAKES BASIC HYDROLOGIC DATA

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The Great Lakes St. Lawrence System extends some two thousand miles from the headwaters of Lake Superior to the Gulf of St. Lawrence. Thus, it reaches almost half way across the North American continent, and its waters border on eight states of the United States and two provinces of Canada. The upper and international portion of the system contains the Great Lakes and drains a basin of more than 295,000 square miles to the outlet of Lake Ontario. This vast series of lakes and rivers is shared by the United States and Canada, and therefore the joint use of the water by both countries poses numerous international problems in the solution of which co-ordinated basic data are required.

Prior to 1953, data pertaining to the hydraulic and hydrologic factors of the Great Lakes and the St. Lawrence River were compiled independently by the responsible government agencies in Canada and the United States with only superficial and informal correlation of some of the data. As a consequence, the data in many instances were developed on different bases, and were divergent in many respects.

International problems were greatly increased by the advent of high lake levels in 1952 and by the then imminent power and navigation development in the St. Lawrence River. Recognizing that continued independent development of the basic data was illogical under the circumstances and that early agreement upon hydraulic and hydrologic factors was of paramount importance, officers of the Corps of Engineers, United States Army, and the Department of Transport, Mines and Technical Surveys, and Resources and Development (now Northern Affairs and National Resources) conducted negotiations early in 1953 to establish a basis for the development and acceptance of identical data by both countries. The negotiations culminated in a meeting of representatives at Ottawa on 7 May 1953.

At this meeting, the Co-ordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data was formed. Recommendations of the committee were to be advisory to the agencies of the United States and Canada which are charged with the responsibility for collecting and compiling Great Lakes hydraulic and hydrologic data. The committee included three members each

from Canada and the United States, The Chairman of the Canadian Section since the committees inception is Mr. T. M. Patterson, Director, Water Resources Branch of the Department of Northern Affairs and National Resources. His United States counterpart is Mr. F. F. Snyder, attached to the Office of the Chief of Engineers of the U.S. Army. Others serving on the Committee are Mr. C. M. Cross of the Department of Mines and Technical Surveys, Mr. D. M. Ripley of the Department of Transport, and Mr. H. F. Lawhead and Mr. W. T. Laidly of the Corps of Engineers, U.S. Army.

In order to conduct the detailed studies and to assist the Co-ordinating Committee in Its undertakings, four sub-committees have been formed with membership chosen from the technical staffs of the various agencies represented on the main committee. These sub-committees, as descriptive of their responsibilities, are called The River Flow Sub-Committee, The Vertical Control Sub-Committee, The Lake Levels Sub-Committee, and The Physical Data Sub-Committee. Their combined responsibilities cover the main fields of activity of the Co-ordinating Committee. I will endeavor to review briefly the achievements under this arrangement and the studies which are in progress.

The co-ordination of river flow data was given early attention, and in 1958 a report on Lake Ontario outflows for the period 1860 to 1954 was submitted to the pertinent governmental agencies in both countries. The flows presented were adopted as co-ordinated data. This report, which is available to interested parties, includes tabulations of monthly St. Lawrence River flows from June 1860 to 1954 and daily flows from October 1917 to 1954. The reason that daily flows are available only for the more recent period is that data from recording gauges were available only for that period. As an illustration of the complexity of the work of the River Flow Sub-Committee, a total of 478 separate measurements of the outflow of Lake Ontario from 1911 through 1955 were analyzed in order to derive rating curves. Complex gauge relationship studies and evaluations of the effects of ice and channel changes at the outlet of the lake were also necessary. The committee is satisfied that although the flows are only carried up to 1954 in the report, it has provided the means for the co-ordination of flows from that time forward.

Since the completion of the St. Lawrence work, considerable progress has been made on a similar study of the Niagara River flows. It is expected that a report will be available on Niagara River flows within a year. A start has been made also on the co-ordination of the flows of the St. MaryÆs River. After these reports are completed, it is anticipated that the attention of the River Flow Sub-Committee will be directed to the complex problem of flow derivation for the Detroit and St. Clair Rivers.

The activities of the Vertical Control Sub-Committee have revolved around the establishment of the International Great Lakes Datum 1955. Illustrative of one of the problems encountered was the movement of the crust of the earth in the Great Lakes region with respect to sea level. Because the rate of movement is not uniform throughout the area, elevations of bench marks are changing with respect to each other and with respect to sea level. One reasoo this new datum was necessary was to determine the amount of

crustal movement prior to 1955 and the effect of this movement on the lake gauges; the other reason was to provide a common datum which could be used by all agencies interested in vertical control in the Great lakes system and so eliminate the confusion arising from the use of the three or four datums in the area.

Father Point was selected as the location of the reference zero because a) it was at the outlet of the system, b) the tidal gauge there has a long period of record, c) the mean water level at that point approximates sea level, and d) because much of the first order leveling necessary was done. In order to extend the datum from the reference zero to the upper Great Lakes, almost 600 miles of first order levels had to be run by the Geodetic Survey of Canada and the U.S. Lake Survey. Extensive crustal movement studies making use of historic water level records on all the Great Lakes were made at various gauge locations. All levels were computed using dynamic values, which are not true elevations. The dynamic value at a point is the work required to raise a one-pound mass against the force of gravity to the level surface in question. Dynamic values were used in preference to orthometric or instrumental levels because of their distinct advantage in hydraulic studies. These monumental tasks were the basis of a Co-ordinating Committee report entitled "Establishment of International Great Lakes Datum 1955," dated September 1961.

This report was accepted by the governmental agencies in each country and since January of this year water levels in the Great Lakes system in both countries are being reported on IGLD 1955. Copies of this report are available, A great deal of interest has been stimulated by the introduction of IGLD 1955. It will replace such datums as the U.S. Lake Survey 1935 Datum, the Geodetic Survey of Canada Datum (with respect to water levels), the Georgian Bay Ship Canal Datum, and many other local datums. During the course of the Vertical Controls Sub-Committees studies, crustal movement studies were made on each of the Great Lakes. These indicated a movement of the earths crust which on Luke Ontario was of the order of one foot per 100 years from the eastern to western end of the lake. In this instance the eastern end was rising with respect to the western end. This phenomenon was found on all the lakes with the northern and eastern sections rising with respect to the southern and western sections.

The Lake Levels Sub-Committee has been actively engaged in two major activities. First, they have studied locations of new gauges where such gauges are required on the Great Lakes System, and second they have been working on a history of water level gauges on the Great Lakes system. This historical study covers a period of over one hundred years and traces the location, gauge zero and other pertinent data for each of the gauges in the system for which records are available. The report on the history of St. Lawrence and Lake Ontario gauges should be available within several months. Work is also progressbig on the history of gauges on the other lakes and connecting rivers. Each of these reports will include the following information:

a) Location and type of station and gauging equipment
h) Agency operating the station
c) How the datum was established and how it was maintained during the period the station was in operation,

With respect to the other major activity of the Lake Levels Sub-Committee, namely the improvement of the pattern of water level gauges, several installations in this program have been made in the past few years: at Gros Cap on Lake Superior, Parry Sound on Georgian Bay, Belle River and Grosse Point Yacht Club on Lake St. Clair, and Barcelona on Lake Erie.

The fourth sub-committee, that concerned with physical data, is studying co-ordination of such basic data as drainage areas, water surface areas, shore line lengths, volume of water, maximum and average depth and many other such physical dimensions for each of the Great Lakes. The work completed to date includes the land drainage and water areas of Lake St. Lawrence, Lake Ontario, Lake Erie and Lake St. Clair as well as St. Clair River, Detroit River and Niagara River. You may also be interested to know that the average depth of Lake Ontario determined by the sub-committee Is 283 feet and the volume of water contained in the lake is 393 cubic miles.

From my remarks on the progress of the Co-ordinating Committee in its various activities, it must be concluded that though much valuable work has been done, much remains to be done. It is obvious also that since our two nations are co-operating actively in projects along this great inland waterway, the hydrologic data used in the design and operation of these projects must be as precise as possible and must be mutually acceptable.